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(54) **NEEDLE PROTECTION DEVICE WITH DAMPENER**

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(52) **U.S. Cl.** **604/192**

(58) **Field of Classification Search** 604/110,
604/164.08, 192, 263; 128/919

See application file for complete search history.

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5,891,103 A * 4/1999 Burns 604/192
5,993,426 A * 11/1999 Hollister 604/192

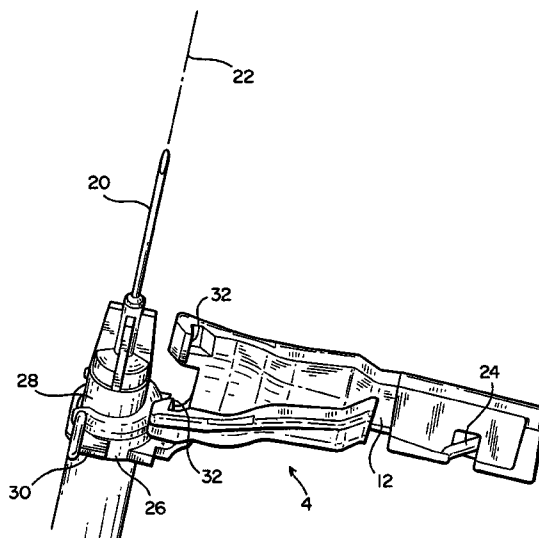
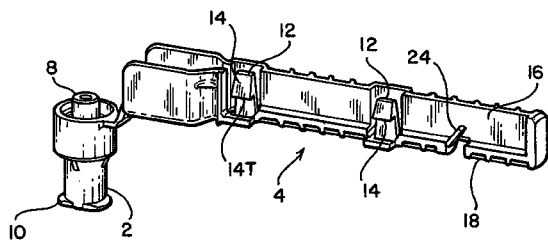
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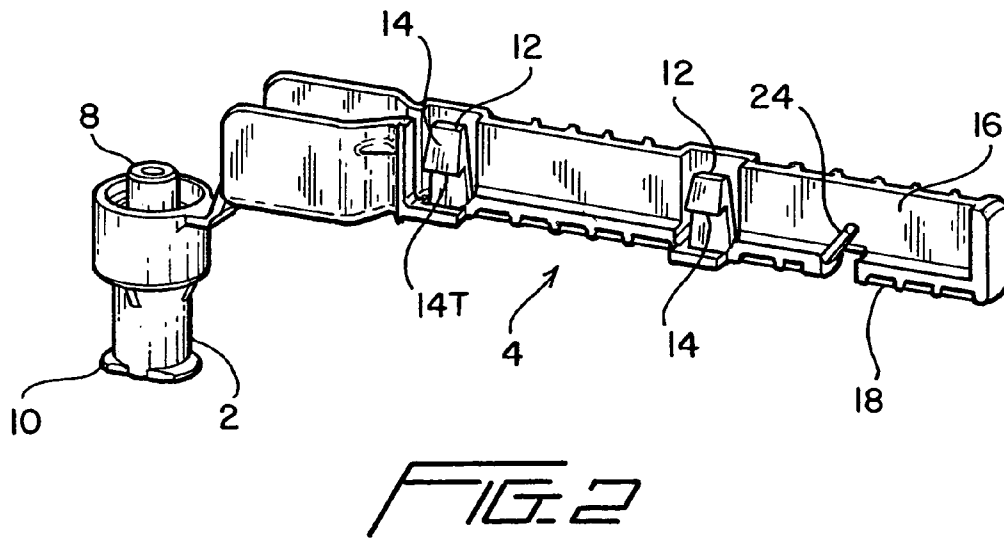
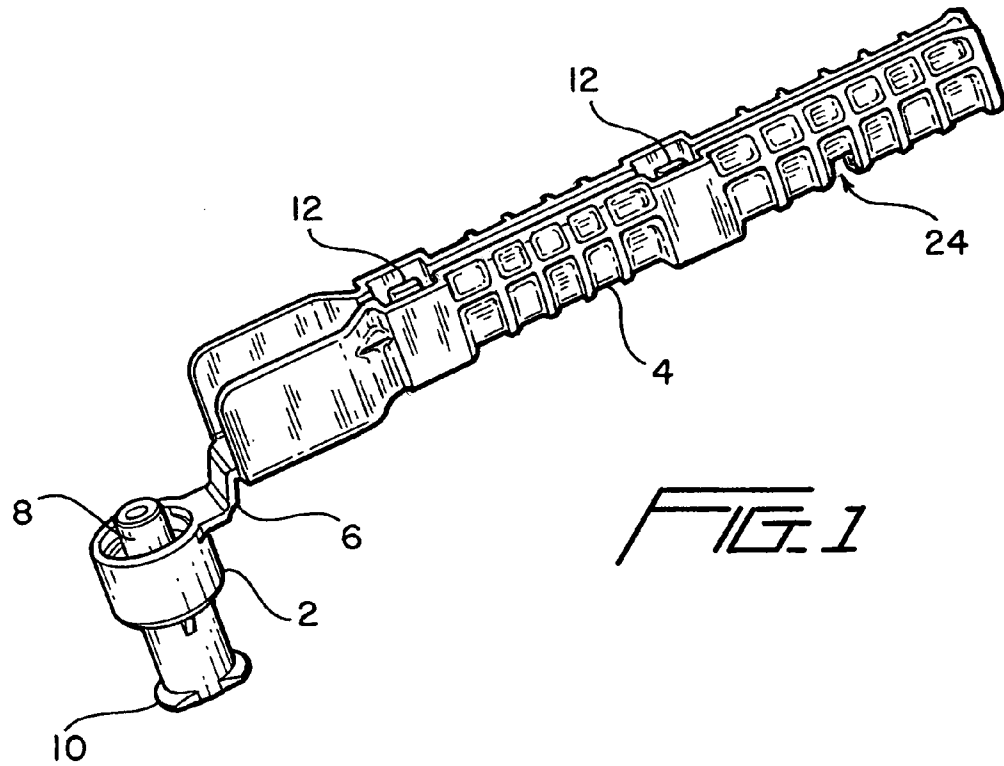
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(57) **ABSTRACT**

To prevent fluid collected at a contaminated needle from being splattered to the environment when the housing of a needle protection device is pivoted to enclose the needle, a bias member is provided in the needle protective housing to provide damping for the needle as the needle is moved within the housing. By damping the movement of the needle relative to the needle housing, splattering of the fluid that results from the jerky movements of the needle due to sudden acceleration/deceleration of the needle relative to the housing are absorbed and/or suppressed.

29 Claims, 5 Drawing Sheets





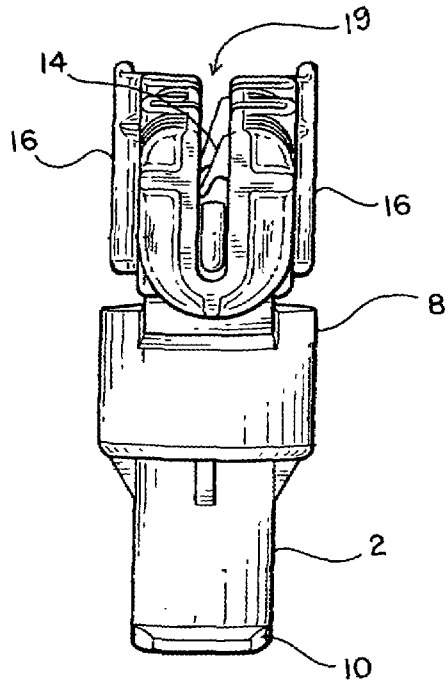


FIG. 3

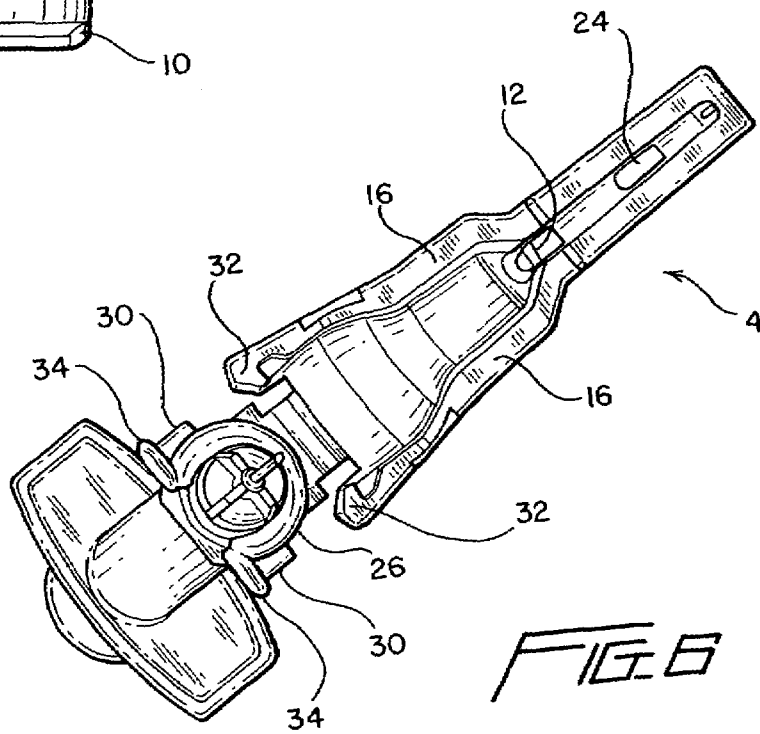
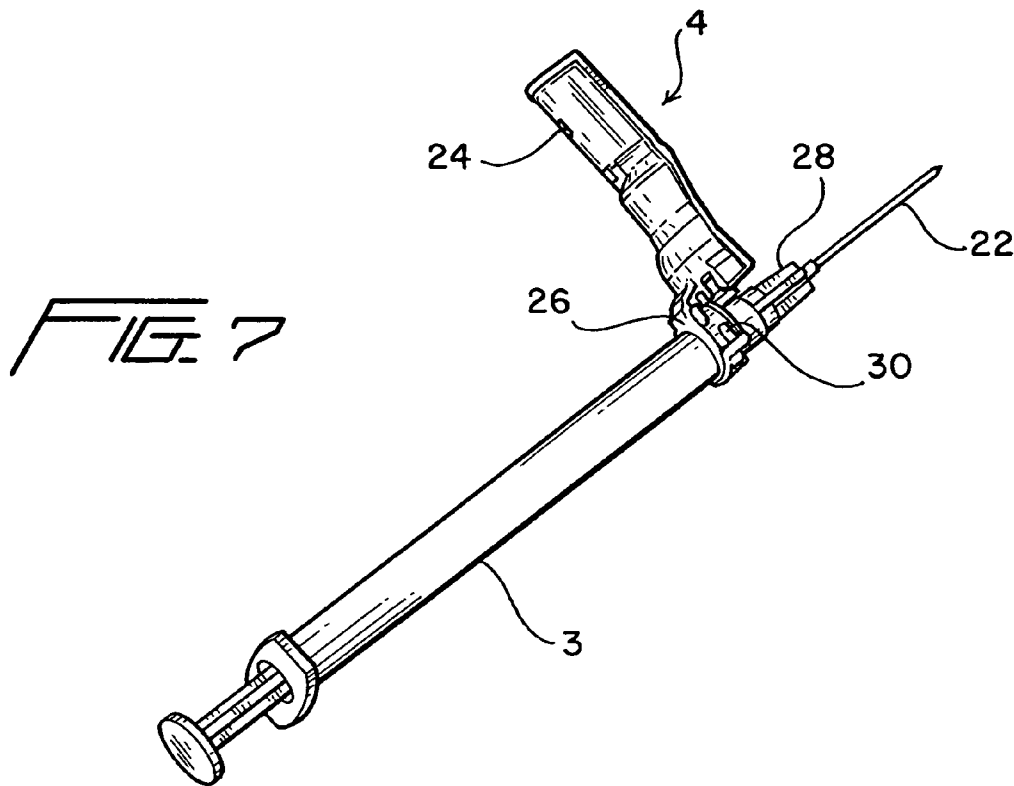
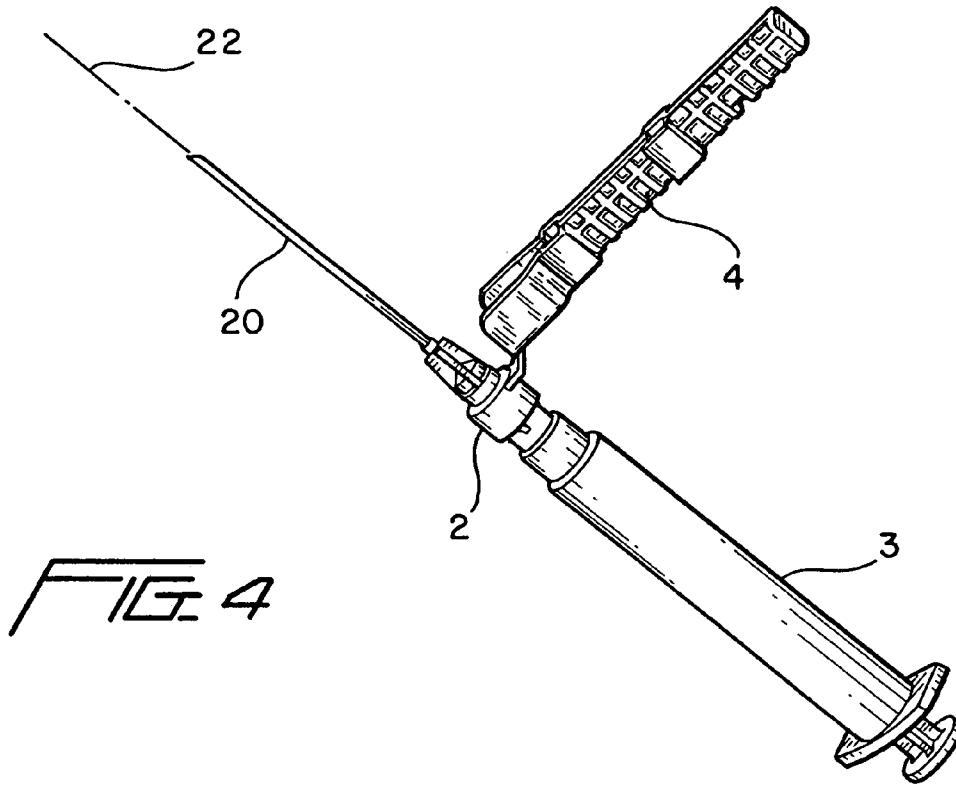


FIG. 6



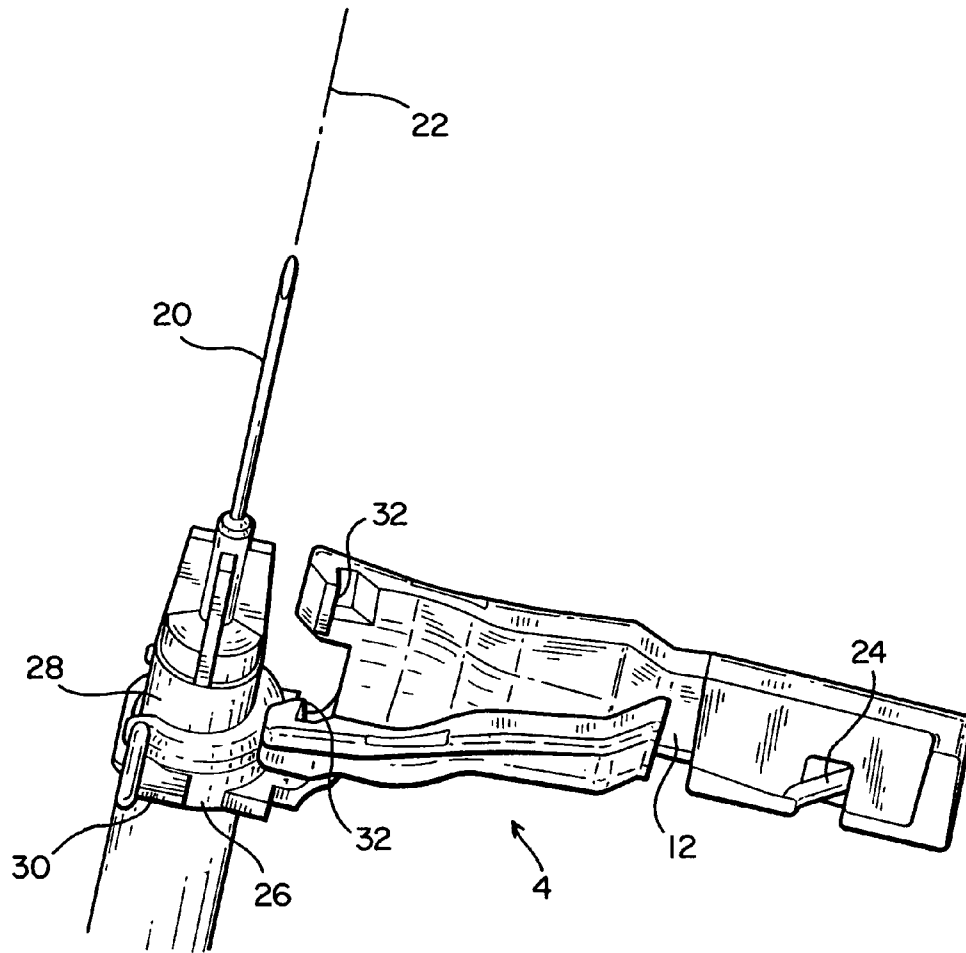


FIG. 5

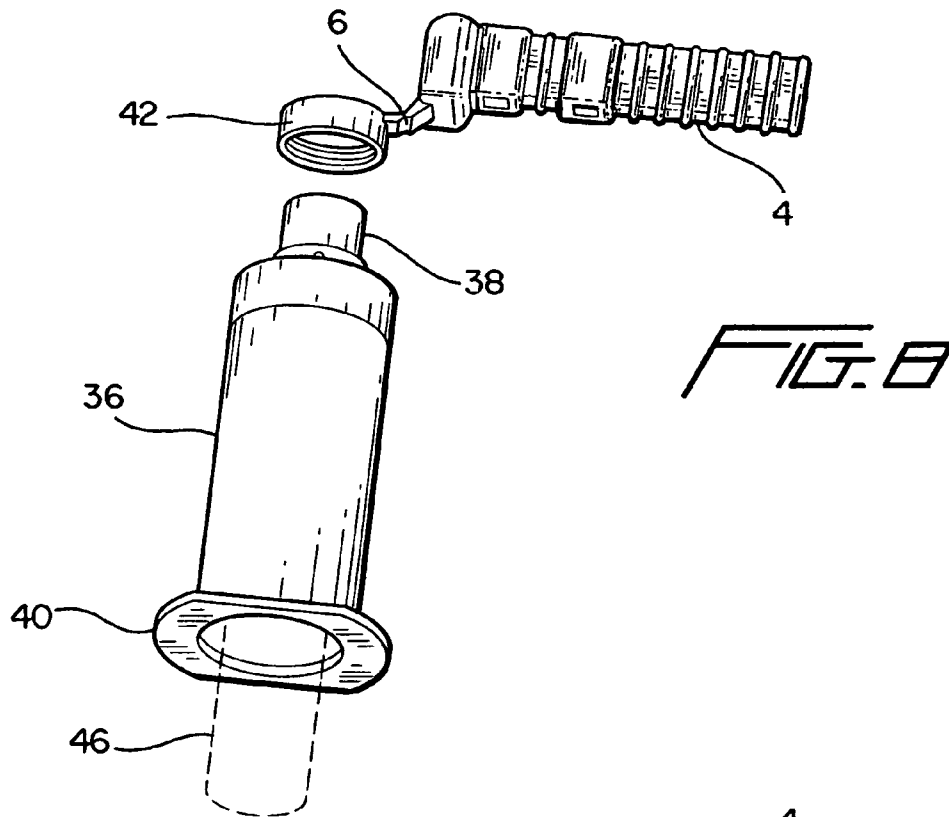


FIG. 8

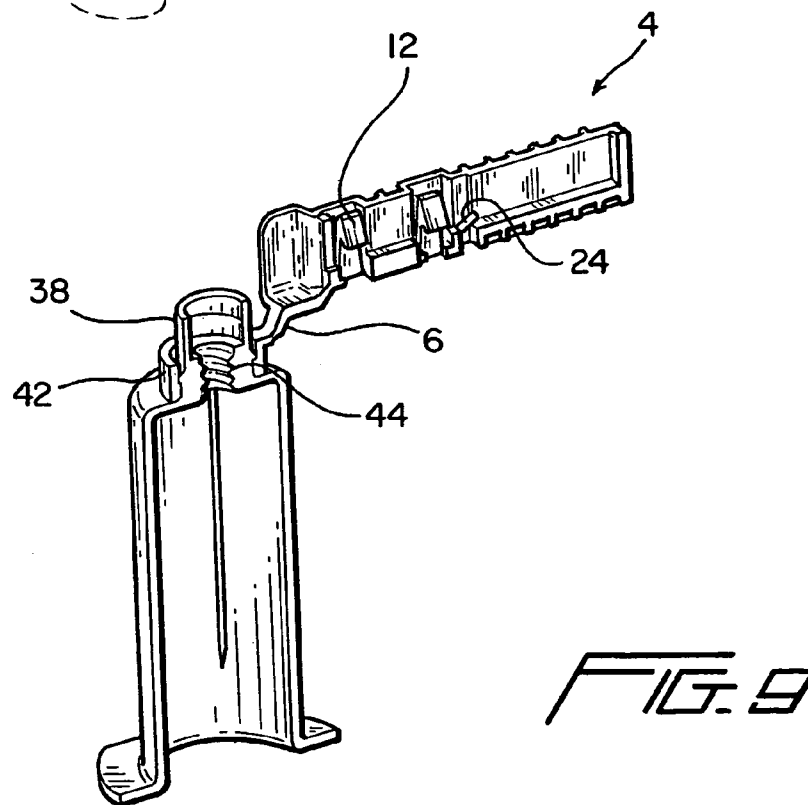


FIG. 9

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NEEDLE PROTECTION DEVICE WITH DAMPENER

FIELD OF THE INVENTION

The instant invention relates to needle safety devices and particularly a needle protection housing that is provided with a dampener that controls the movement and vibrations of a needle as the needle is being enclosed by the housing.

BACKGROUND OF THE INVENTION

For those needle protection devices that have a housing either hinged or flexibly connected to a base to which a needle is matable or extends, when the needle sheath is pivoted to cover the needle, as the needle retaining mechanism for example a hook inside the needle sheath makes contact with the needle and then flexes over to grip the needle, the relative movement between the needle and the housing is interrupted abruptly so as to cause vibrations to the needle due to the sudden deceleration and then acceleration of the needle relative to the housing. This sudden deceleration/acceleration of the needle relative to the housing causes the needle to vibrate or jerk such that whatever fluid the needle has carried thereon is splattered to the environment or atomized to the atmosphere. Given that the fluid carried by the needle usually consists of blood which may well carry some contagious diseases such as the HIV virus, any excessive splattering, splashing or aerosolizing of the contaminated blood into the environment needs to be avoided. Accordingly, there is a need for a needle protection device, and more particularly the sheath or housing to the needle protection device, that has a feature that substantially prevents a needle from vibrating or jerking when it is being enclosed by the sheath.

In Hollister U.S. Pat. No. 5,993,426, there is disclosed a needle sheath that has fitted to the distal end thereof a material such as for example cotton that can absorb fluid collected at the tip of the needle cannula. The material that is fitted to the distal end of the needle sheath acts to absorb fluid that may be collected at the tip of the needle, before the needle makes contact with the needle retaining hook, so as to prevent the splattering of the fluid when the needle does make contact with the hook. One problem with the '426 device is that it is difficult to manufacture since the liquid absorbent material most likely needs to be hand fitted and glued to the distal end of the needle. The manufacturing cost for the device disclosed in the '426 patent may also be unacceptably high due to the additional expense of the absorbent material.

SUMMARY OF THE PRESENT INVENTION

The safety device of the instant invention is an improvement of any one of a series of Hollister U.S. patents assigned to the same assignee as the instant invention. These include: U.S. Pat. Nos. 4,982,842; 5,139,489; 5,154,285; 5,232,454; 5,232,455; 5,277,311; 5,423,765; 5,993,426; RE37,110 and RE37,252. The respective disclosures of the aforementioned Hollister U.S. patents are incorporated by reference to the instant disclosure.

To overcome the potential splattering of contaminated fluid from a needle cannula, the cannula protective sheath or housing of the instant invention device is fitted with a bias member that could be in the form of a leaf spring or a flexible flap or extension that extends, integrally or otherwise, from the back wall from the housing. The orientation and positioning of the bias member in the housing is such that when it makes contact with the needle, it would provide a biasing or dampening

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force against the needle and at the same time yield to the movement of the needle relative to the housing so that the needle is prevented from any sudden acceleration/deceleration movements when it makes contact with the needle retention mechanism in the protective sheath, or when a locking mechanism at the needle housing comes into contact and coacts with a matching locking mechanism at the base of the device and/or the needle hub of the needle assembly that is mated to the device.

It is therefore an objective of the present invention to provide a needle safety device that prevents fluid collected at a contaminated needle from being splashed, splattered or aerosolized when the sheath of the device is pivoted to cover and then fixedly retain therein the contaminated needle.

It is also an objective of the present invention to provide a simple to manufacture needle protection device that prevents fluid collected at a needle from splattering.

BRIEF DESCRIPTION OF THE FIGURES

The above mentioned objectives and advantages of the present invention will become apparent and the invention itself be best understood by reference to the following description of the present invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a safety device of the instant invention;

FIG. 2 is a semi-cut away perspective view of the FIG. 1 device illustrating in particular the inventive dampener;

FIG. 3 is a frontal view of the device of FIG. 1 in which a viewer can look through the slot of the needle protection sheath or housing;

FIG. 4 is a perspective view illustrating the mating of the safety device of FIG. 1 to a syringe;

FIG. 5 is a perspective view of a second embodiment of the instant invention in which the inventive dampener is incorporated to a device disclosed in a co-pending application;

FIG. 6 is a top view of the FIG. 5 device;

FIG. 7 is a perspective view illustrating the mating of the device of FIG. 5 with a syringe;

FIG. 8 is a perspective view of a Vacutainer holder to be fitted with the needle protection housing of the instant invention; and

FIG. 9 is a semi-cut away perspective view of a Vacutainer holder fitted with the needle protection housing of the instant invention.

DETAILED DESCRIPTION OF THE INVENTION

In the aforementioned U.S. Pat. No. 4,982,842, an adapter for providing a safety needle sheath for housing a contaminated needle is disclosed. For illustration purposes, FIG. 1 is an improvement of the safety needle adapter disclosed in the '842 patent, although it should be appreciated that the improved needle protection sheath as disclosed in the instant invention is applicable to all of needle protective housings disclosed in all of the above noted incorporated by reference patents assigned to the assignee of the instant invention.

With reference to FIG. 1, a device similar to that disclosed in the '842 patent for accepting a needle is shown to have a base adapter 2 to which a housing 4 is connected by a living hinge 6. Note that housing 4 may also be connected to base 2 by means of a hinge or other pivoting mechanisms. Base 2 has a first luer end 8 for mating with the needle hub of a needle and a second luer end 10 for mating with a conventional syringe. As best shown in the semi-cut away view of FIG. 2 and the frontal view of FIG. 3, housing 4 has a number of needle grip

means **12** in the form of hooks each having a lip **14** extending from the main body of hooks **12**.

Housing **4** is comprised of two sidewalls **16** and a back wall **18**, partially shown in FIG. 2. Due to the configuration of the extending sidewalls **16**, a slot **18** runs longitudinally along the length of housing **4** to provide a passage wherethrough a needle cannula such as needle **20** shown in FIG. 4 passes, when housing **4** is pivoted towards the longitudinal axis **22** of base **2**.

Prior to the instant invention, for the needle protection device such as that disclosed in the '842 patent, when housing **4** is pivoted to cover needle **20**, as needle **20** comes into contact with lip **14**, the relative movement of needle **20** is slowed, or decelerated. As the movement of needle **20** relative to housing **4** continues, the speed with which needle **20** moves continues to be slowed by lip **14** until needle **20** reaches tip **14t** of lip **14**, at which time the speed with which needle **20** moves relative to housing **4** increases due to the lack of contact with lip **14**. In other words, the movement of needle **20** relative to housing **4** is accelerated, thereby causing needle **20** to suddenly jerk forward. At the same time, lip **14**, due to its inherent elasticity, returns to its original orientation, so as to snap over needle **20**, which has moved beyond tip **14t**. The snapping motion of lip **14** to needle **20** in turn causes needle **20** to vibrate, as needle **20** is caught by hook **12** and fixedly retained thereby in the recess of housing **4**. Before the instant invention, the snap retention of needle **20** by hook **12**, combined with the deceleration, sudden acceleration and stop movements of needle **20** relative to housing **4** cause needle **20** to vibrate or jerk to thereby splatter any fluid collected on needle **20**.

To prevent such sudden jerky movements and vibrations in needle **20**, the present invention incorporates into housing **4** a tongue or flap **24** that extends from back wall **18** at a given orientation. Although shown in FIG. 2 as extending from back wall **18** in a direction towards the distal end of housing **4**, it should be appreciated that flap **24** may also be configured to extend from back wall **18** at location **19** in a direction where the tip of flap **24** is oriented or pointing towards the proximal end of housing **4**. In other words, flap **24** could be oriented so as to face in either direction, for example forwardly as shown in FIG. 2, or backwardly.

For the embodiment shown in the figures, flap **24** is flexibly integrated to back wall **18** and extends in such manner at an angle relative to the oncoming needle that it comes into contact with needle **20** after needle **20** has entered passageway **18** but before needle **20** has reached the position, or even comes into contact with lip **14**, whereby it becomes fixedly retained by hooks **12** within housing **4**. Flap **24** thereby acts as a dampener, or shock absorber, for needle **20** as the latter moves relative to housing **4**, by damping the vibrations and jerky motions that needle **20** otherwise would experience due to the sudden deceleration/acceleration of its movement, as it enters into the recess of housing **4** and be fixedly retained therein, in this instance, by the hooks **12** in housing **4**.

Shock absorbing tongue **24** of the FIG. 2 embodiment extends from back wall **18** of housing **4** in a yieldingly bent manner so that when it comes into contact with needle **20**, it is yieldingly moved by needle **20** towards back wall **18**, and yet at the same time applies a biasing force to needle **20** to thereby smoothly damp the movement of needle **20**. Thus, by modulating the speed with which needle **20** moves within housing **4**, dampener flap **24** prevents the fluid collected on needle **20** from being splattered or aerosolized into the environment.

By integrating dampener **24** directly to housing **4**, the manufacturing cost of providing such a biasing mechanism

for housing **4** is de minimis. In place of an integrated dampener, a leaf spring with the same configuration may be press-fitted into the distal end of housing **4** to provide the same biasing damping force against needle **20**. Although the cost for the fitting of such a leaf spring, be it metallic or plastic, is most likely higher than the integrated dampener shown in FIG. 2, the manufacturer cost for such hard-pressed leaf spring nonetheless is less than the manufacturing cost for the needle safety device disclosed in the aforementioned patent. As noted above, the dampener of the instant invention may be added to the needle protection housing of all of the aforementioned Hollister patents.

FIGS. 5, 6 and 7 illustrate the addition of the inventive dampener to the inventive needle protection device disclosed in copending application Ser. No. 09/883,360 filed Jul. 19, 2001 entitled "Needle Safety Device With Anti Removal Protection". The disclosure of the '360 application is incorporated by reference herein.

For the embodiment of the instant invention shown in FIGS. 5, 6 and 7, components the same as or similar to the earlier discussed components are numbered the same. As shown, the base of the needle protection device of the second embodiment is in the form of a collar **26** that fits about the hub **28** of a needle assembly, or the distal end of a syringe having an integrated hub to which a needle cannula **20** extends. Collar **26** has two ears **30** extending therefrom that coact with corresponding fingers **32** formed at the lower portion of each of the sidewalls **16** of housing **4**. When housing **4** is pivoted toward needle **20** into substantial alignment along the longitudinal axis of needle **20**, ears **30** and fingers **32** coact to fixedly retain housing **4** along the longitudinal axis **22**, to thereby envelop needle **20** within housing **4**. Two arms **34** formed at the respective ends of collar **26** prevent any tampering of the fixedly retained ears **30** and fingers **32**. If desired, a hook **12** may also be provided integral of housing **4** to retainedly grasp needle **20**.

To prevent needle **20** from vibrating due to the relative movement between it and housing **4**, a tongue or flap **24** is provided at the distal end of housing **4** as in the previous embodiment so that a dampener is provided within housing **4**. The operation of dampener **24** is as was discussed in the first embodiment so that, as housing **4** is pivoted toward the longitudinal axis **22** and fingers **32** coact with ears **30**, as well as when needle **20** is grasped by hook **12** if hook **12** indeed is present, flap **24** acts as a dampener or shock absorber to modulate the movement of needle **20** relative to housing **4** to thereby substantially damp vibrations to needle **20** that result from housing **4** being snappedly locked to base **2**, or needle **20** being snappedly gripped by hook **12**. As shown, bias member **24** is oriented at a given angle with respect to the back wall of housing **4**. Same as in the first embodiment, instead of an integral dampener, a leaf spring may be fitted to the distal end of housing **4**.

Yet another device fitted with a needle protection sheath having the inventive dampener is shown in FIGS. 8 and 9. In particular, FIG. 8 shows a Vacutainer holder **36** such as that disclosed in the aforementioned incorporated by reference Hollister U.S. Pat. No. 5,154,285. Holder **36** has one end **38** and another end **40**. End **38**, considered as the hub of holder **36**, is rotatably fitted with a base **42**, in the form of a collar, to which a housing **4** is attached by means of hinge **6**. As disclosed in the '285 patent, hub **36** is adaptable to mate with a needle assembly that comprises a double-ended needle one of which extends from hub **38** while the other of which extends to the inside of holder **36**. As is well known, the double-ended needle assembly has a threaded hub that threadingly mates to hub **38**. The threads to which the hub of the double-ended

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needle assembly is mated in hub **36** is designated **44** in the semi-cut away perspective view of FIG. **9**.

As best shown in FIG. **9**, as with the embodiments discussed above, housing **4** fitted to the holder of FIGS. **8** and **9** likewise has integral hooks **12**, as well as dampener **24**. The respective operations of the needle gripping hooks **22** and dampener **24** are as were discussed with the earlier embodiments.

In operation, after a double-ended needle assembly is mated to hub **38**, a vial or tube **46** for holding or collecting the fluid such as blood from the patient is inserted to end **40** of holder **36** so as to effect a fluid communication by means of the inward pointing needle of the double-ended needle. After the needle that is inserted into patient is withdrawn from the patient, housing **4** is pivoted via hinge **6** to a position substantially in alignment along the longitudinal axis of holder **36** so as to envelope the needle extending from hub **38**, with hooks **12** eventually grasping the needle. As was discussed previously, dampener **24** prevents vibrations and jerky movements of the needle during the process which leads the needle becoming fixedly retained in housing **4**.

In as much as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter described throughout this specification and shown in the accompanying drawings be interpreted as illustrative only and not in a limiting sense. For example, a coil spring may be used in place of the above-disclosed leaf spring. Accordingly, it is intended that the instant invention be limited only by the spirit and scope by the hereto appended claims.

The invention claimed is:

1. A needle protection housing, comprising:
 - a longitudinal body having a back wall and two sidewalls extending therefrom to form a slot through which a needle passes into said body; and
 - a bias member inside said body for yieldingly making contact with said needle after said needle enters said body but before said needle reaches a position where it becomes fixedly retained within said body, said bias member yielding to movement of said needle as said needle makes contact therewith for dampening movements and vibrations of said needle as said needle moves to said position so as to be fixedly retained within said housing.
2. The housing of claim 1, further comprising:
 - needle grip means inside said body for gripping said needle to fixedly retain said needle within said body when said needle is moved into said position.
3. The housing of claim 2, wherein said needle grip means comprises at least one hook integral of said body for gripping said needle to fixedly retain said needle within said body.
4. The housing of claim 1, wherein said bias member integrally extends upwards from said back wall of said body to act as a shock absorber to dampen the movement of said needle when said needle comes into contact therewith.
5. The housing of claim 4, wherein said bias member comprises a flap that extends upwardly at an angle from said back wall to provide a biasing force against said needle upon making contact therewith, said flap giving way to said needle by moving downwards toward said back wall as said needle is moved toward said position.
6. The housing of claim 1, wherein said bias member comprises a leaf spring fitted to said body.
7. The housing of claim 1, further comprising:
 - a base hingedly connected to said body;
 - at least one locking means at said base;
 - at least an other locking means at said body;

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wherein said one and other locking means at said base and body coact with each other to fixedly retain said body relative to said base when said body is pivoted to align along a longitudinal axis of said base to thereby fixedly retain said needle within said body.

8. Apparatus, comprising:
 - a base;
 - a housing flexibly or hingedly connected to said base so as to be pivotable relative to said base; and
 - a bias means inside said housing for yieldingly making contact with a needle extending from said base or a needle hub about which said base is mounted after said housing is pivoted toward said base and said needle enters said housing but before said needle reaches a position where it becomes fixedly retained within said body, said bias means yielding to movement of said needle as said needle makes contact therewith so that movements and vibrations of said needle are dampened as said needle is moved to said position.
9. Apparatus of claim 8, further comprising:
 - needle grip means inside said housing for fixedly retaining said needle within said housing when said needle is moved into said position.
10. Apparatus of claim 9, wherein said needle grip means comprises at least one hook integrated to said housing for gripping and fixedly retaining said needle within said housing.
11. Apparatus of claim 8, wherein said housing includes a back wall; and
 - wherein said bias means integrally extends upwards from said back wall to act as a shock absorber to dampen the movement of said needle when said needle comes into contact therewith.
12. Apparatus of claim 8, wherein said bias means comprises a flap that extends upwardly at an angle from said back wall to provide a biasing force against said needle when said needle makes contact therewith, said flap giving way to said needle by moving downwards toward said back wall as said needle is moved toward said position.
13. Apparatus of claim 8, wherein said bias member comprises a leaf spring fitted to said housing.
14. Apparatus of claim 8, further comprising:
 - at least one locking means provided at said base;
 - at least an other locking means provided at said housing;
 - wherein said one and other locking means at said base and housing coact with each other to fixedly retain said housing relative to said base when said housing is pivoted to align along a longitudinal axis of said base to thereby fixedly retain said needle within said housing.
15. Apparatus of claim 8, wherein said base comprises a collar fittable to a needle hub wherefrom said needle extends.
16. Apparatus of claim 8, wherein said base comprises a first end to which said needle is mated or from which said needle extends and a second end for mating to a syringe.
17. Apparatus of claim 8, wherein said base is integrated to a syringe.
18. Apparatus of claim 8, wherein said base comprises a collar rotatably fitted to a holder having one end for accepting a double-ended needle and an other end for accepting a fluid holding tube.
19. Apparatus of claim 18, wherein said housing comprises needle grip means for fixedly retaining one end of said double-ended needle that extends away from said one end of said holder.
20. In combination, a needle hub having a needle extending therefrom, a housing pivotable relative to said needle hub, a bias member in said housing for making contact with said

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needle when said housing is pivoted to be in alignment with said hub, said bias member being provided in said housing in such manner that it makes contact with and yields to movement of said needle after said needle has entered into said housing and needle retention means for fixedly retaining said needle within said housing when said housing is moved to a position substantially in alignment with said needle hub.

21. Combination of claim 20, wherein said needle retention means comprises at least one hook integral of said housing for gripping said needle to fixedly retain said needle within said body when said housing is moved to said alignment position.

22. Combination of claim 21, further comprising a base fitted to said needle hub, at least one locking means provided at said base, at least an other locking means provided at said housing, wherein said one and other locking means at said base and housing coact with each other to fixedly retain said housing relative to said base when said housing is pivoted to said alignment position.

23. Combination of claim 21, further comprising at least one locking means provided at said needle hub, at least an other locking means provided at said housing, wherein said one and other locking means at said needle hub and said housing coact with each other to fixedly retain said housing relative to said base when said housing is pivoted to said alignment position.

24. Combination of claim 20, wherein said housing includes a back wall, and wherein said bias member integrally extends upwards from said back wall to act as a shock absorber to dampen the movement of said needle when said needle comes into contact therewith.

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25. Combination of claim 20, wherein said housing includes a back wall, and wherein said bias member comprises a flap that extends upwardly at an angle from said back wall to provide a biasing force against said needle upon making contact therewith, said flap giving way to said needle by moving downwards toward said back wall as said needle is moved toward said alignment position.

26. Combination of claim 20, wherein said bias member comprises a leaf spring provided in said housing.

27. Combination of claim 20, further comprising a base fitted to said needle hub, at least one locking means provided at said base, at least an other locking means provided at said housing, wherein said one and other locking means at said base and housing coact with each other to fixedly retain said housing relative to said base when said housing is pivoted to said alignment position.

28. Combination of claim 20, further comprising at least one locking means provided at said needle hub, at least an other locking means provided at said housing, wherein said one and other locking means at said needle hub and said housing coact with each other to fixedly retain said housing relative to said base when said housing is pivoted to said alignment position.

29. Combination of claim 20, wherein said needle hub is one end of a holder having an other end for accepting a fluid holding tube, and wherein said needle extending from said one end of said holder is one needle of a double-ended needle mated to said one end of said holder.

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